AMENDMENTS TO THE CLAIMS

The following listing of claims replaces all previous listings and versions of claims in this application:

1. (Currently amended) A method of recycling a donor wafer after detachment of a useful layer of a semiconductor material therefrom, wherein the donor wafer, after detachment of the useful layer, includes a substrate, a buffer structure on the substrate, and a remaining portion of the useful layer, the buffer structure including a buffer layer that has a first side with first crystalline properties, for association with the substrate, and a second side with second crystalline properties that are different from the first crystalline properties, for association with the useful layer, and a portion transitioning between the first and second properties, which method comprises mechanically removing at least part of the remaining portion of the useful layer while preserving the buffer layer in order to provide a donor wafer surface that is suitable for use in a subsequent detachment of a new useful layer.

2. (Currently amended) The method of claim 1, wherein the mechanically removing comprises polishing~~, optionally accompanied by chemical etching~~.

3. (Original) The method of claim 2, wherein the polishing is abrasive polishing or chemical-mechanical planarization.

4. (Currently amended) The method of claim 2, which further comprises conducting a surface smoothing treatment before polishing, after polishing, or both before and after polishing to enable providing the new useful layer thereon.

5. (Original) The method of claim 4, wherein the surface smoothing treatment includes a heat treatment.

6. (Currently amended) The method of claim 1, wherein, before detachment, the buffer structure includes ~~a buffer layer and~~ an additional layer associated with the second side. ~~that has (a) a thickness which is sufficient to contain defects therein or (b) a surface lattice parameter which is substantially different from that of the substrate.~~

7. (Original) The method of claim 6, wherein the mechanically removing includes removing all of the remaining portion of the useful layer and part of the additional layer or all of the additional layer and part of the buffer layer.

8. (Currently amended) The method of claim 1, which further comprises providing at least one new layer on the donor wafer after mechanically removing at least part of the remaining portion of the useful layer so as to form a new useful layer ~~or new buffer structure~~ above the existing buffer structure.

9. (Original) The method of claim 8, which further comprises, before detachment, providing the donor wafer with an overlayer which includes the useful layer to be detached, and wherein the mechanically removing removes any portion of the overlayer that remains after detachment.

10. (Original) The method of claim 9, wherein the overlayer includes
(a) a material selected from the group consisting of SiGe and strained Si;
(b) a material selected from the group consisting of AsGa and Ge; or
(c) InP or another alloy of Group III-V elements.

11. (Original) The method of claim 8, which further comprises providing at least two new layers on the donor wafer after mechanically removing at least part of the remaining portion of the useful layer so as to form an interlayer between the buffer structure and the new useful layer, with the interlayer optionally being provided by layer growth.

12. (Original) The method of claim 11, wherein the interlayer includes
(a) a material selected from the group consisting of SiGe and strained Si;
(b) a material selected from the group consisting of AsGa and/or Ge;
(c) an alloy of Group III-V elements; or
(d) a material selected from the group consisting of InP and a Group III-V material having a lattice parameter substantially identical to that of InP.

13. (Original) The method of claim 11, wherein the buffer structure has a composition that includes an atomic alloy of binary, ternary, quaternary or of higher degree,

selected from the group consisting of Group IV-IV elements; Group III-V elements, and Group II-VI elements.

14. (Original) The method of claim 1, wherein

(a) the substrate includes Si and the buffer structure includes a SiGe buffer layer having a Ge concentration that increases with thickness and a relaxed SiGe layer on the buffer layer;

(b) the substrate includes AsGa and the buffer structure comprises a buffer layer comprising an atomic alloy of Group III-V elements of ternary or higher degree that is selected from possible (Al,Ga,In)-(N,P,As) combinations with at least two additional elements selected from the group consisting of Group III and Group V elements, wherein the two additional elements have a concentration that changes gradually with thickness of the buffer layer;

(c) the donor wafer has at least one layer that includes carbon with a carbon concentration in the layer which is less than or equal to about 50%; or

(d) the donor wafer has at least one layer that includes carbon with a carbon concentration in the layer which is less than or equal to about 5%.

15. (Currently amended) The method of claim 1, which further comprises:
providing a zone of weakness beneath the donor wafer surface;
bonding the donor wafer surface to a surface of a receiving substrate; and
detaching a useful layer from the donor wafer along the zone of weakness.

16. (Original) The method of claim 15, wherein the method further comprises, before the bonding step, forming a bonding layer on the donor wafer surface.

17. (Currently amended) The method of claim 15, wherein the zone of weakness is formed by implantation of atomic species through the useful layer. ~~or by porosification.~~

18. (Original) The method of claim 1, wherein the useful layer that is detached includes part of the buffer structure.

19. (Original) The method of claim 1, wherein the donor wafer includes, before detachment, an overlayer located on the buffer structure, and the useful layer that is detached includes at least part of the overlayer.

20. (Cancelled)

21. (Cancelled)

22. (Cancelled)

23. (Currently amended) ~~The~~ A method of recycling a donor wafer ~~of claim 21, wherein the buffer structure includes~~ after detachment of a portion of an overlayer that includes a useful layer of a semiconductor material therefrom, the donor wafer comprising, after detachment of the useful layer:

a substrate,

a buffer structure on the substrate, and

a remaining portion of the overlayer ~~remains~~ remaining on the buffer structure; and

wherein the method comprises mechanically removing at least part of the remaining portion of the overlayer, including any remaining portion of the useful layer, to provide a donor wafer surface that is suitable for use in a subsequent detachment of a new useful layer.

24. (Currently amended) The ~~donor wafer~~ method of claim 23, wherein the donor wafer further ~~comprising~~ comprises an interlayer between the substrate and the overlayer.

25. (Currently amended) The ~~donor wafer~~ method of claim ~~23~~ 24, wherein:

the overlayer includes:

(a) a material selected from the group consisting of SiGe and strained Si~~;~~,

(b) a material selected from the group consisting of AsGa and Ge~~;~~, or

(c) InP or another alloy of Group III-V elements~~;~~, and

the interlayer includes:

(a) a material selected from the group consisting of SiGe and strained Si,

(b) a material selected from the group consisting of AsGa and/or Ge,

(c) an alloy of Group III-V elements, or

(d) a material selected from the group consisting of InP and a Group III-V material having a lattice parameter substantially identical to that of InP.

26. (Cancelled)

27. (Cancelled)

28. (Cancelled)

29. (New) The method of claim 1, wherein the first crystalline properties comprise a first lattice parameter, and the second crystalline properties comprise a second lattice parameter to enable the useful layer to be associated with the substrate via the buffer layer.

30. (New) The method of claim 29, wherein the substrate has a lattice parameter that is different from the lattice parameter of the useful layer.

31. (New) The method of claim 6, wherein the additional layer has a thickness that is sufficient to contain crystalline defects therein to improve the crystalline qualities of the useful layer on the buffer structure.

32. (New) The method of claim 6, wherein at least part of the additional layer is preserved after the mechanical removing.

33. (New) The method of claim 1, wherein the remaining portion of the useful layer is insufficient to transfer a new useful layer therefrom without adding material thereto.

34. (New) The method of claim 1, wherein the buffer structure is reformed before a new useful layer is added thereon.

35. (New) A method of recycling a donor wafer, comprising:

providing a donor wafer comprising:

a substrate having a substrate lattice parameter;

a buffer structure on the substrate, the buffer structure comprising a buffer layer that has a first side with a first lattice parameter to enable association with the substrate lattice parameter, a second side with a second lattice parameter that is different from the first lattice parameter to associate with a useful layer, and a portion transitioning between the first and second lattice parameters; and

a useful layer of a useful layer material having a useful lattice parameter to enable association with the second lattice parameter, the useful layer being associated with the second side of the buffer layer;

detaching the useful layer from the donor wafer; and

mechanically removing at least part of a remaining portion of the useful layer material from the buffer structure, while preserving the buffer layer to preserve the second lattice parameter on the second side.

36. (New) The method of claim 35, wherein the first lattice parameter substantially matches the substrate lattice parameter, and the second lattice parameter substantially matches the useful layer lattice parameter.

37. (New) The method of claim 35, further comprising, after mechanically removing the at least part of the remaining portion, providing a new useful layer on the surface of the donor wafer for subsequent detachment of the new useful layer without reforming the buffer layer.

38. (New) The method of claim 35, wherein the buffer layer has a composition that varies gradually over the thickness thereof for providing a gradual transition of the lattice parameter.

39. (New) The method of claim 35, wherein the at least part of the remaining portion of the useful layer is mechanically removed without damaging the buffer layer.